

REMARKS

Status Of Application

Claims 1-6 and 17-26 are pending in the application; the status of the claims is as follows:

Claims 1, 2, 5, 17, 18, 23 and 24 are rejected under 35 U.S.C. § 102 (e) as being anticipated by U.S. Patent No. 6,133,671 to Atsuta et al. (hereinafter the "Atsuta Patent").

Claim 6 is rejected under 35 U.S.C. 103(a) as being unpatentable over the Atsuta Patent, in view of U.S. Patent No. 5,646,469 to Tsukimoto et al. (hereinafter the "Tsukimoto Patent").

Claims 19-22 are allowed.

Claims 3, 4, 25 and 26 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Allowable Subject Matter

The allowance of claims 19-22, by the Examiner, is noted with appreciation.

The objection to claims 3, 4, 25 and 26 as being dependent upon a rejected base claim, but allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims, is noted with appreciation.

35 U.S.C. § 102(e) Rejection

The rejection of claims 1, 2, 5, 17, 18, 23 and 24 under 35 U.S.C. § 102(e) as being anticipated by the Atsuta Patent, is respectfully traversed based on the following.

The Atsuta patent shows a push-pull type driver for a piezoelectric element in a vibration type motor. A first driver (4A) provides a signal A_0 that is provided via coil 6 to provide a boosted sinusoidal driving signal A as shown in Figure 2A. A second driver (4A') is provided with an inverted signal by reversing the pull-up and pull-down signals to the driving transistors of the driver. The output of driver 4A' provides an unboosted square wave signal signal A' to the piezoelectric element as shown in Figure 2A.

In contrast to the prior art, claim 1 includes:

a first driver for generating a first driving signal, wherein the first driving signal has a maximum voltage smaller than a voltage of inversion of polarization of the piezoelectric element and has a first waveform derived from the waveform signal, the first driver being coupled to provide the first driving signal to the piezoelectric element in the polarization direction of the piezoelectric element; and

a second driver for generating a second driving signal, wherein said second driving signal has a maximum voltage smaller than the voltage of inversion of polarization of the piezoelectric element and has a second waveform derived from the waveform signal, the second driver being coupled to provide the second driving signal to the piezoelectric element in a direction opposite to the polarization direction;

wherein the first waveform is a polygon waveform and the second waveform is a polygon waveform.

In the Atsuta patent, signal A is a boosted signal having a sinusoidal waveform and signal A' is a square wave. In claim 1, both the first waveform and the second waveform are polygon waveforms. This is supported in the specification at, for example, Figures 14A-14D. To anticipate, a prior art reference must show, expressly or inherently, every limitation of a claim. MPEP §2131. The cited prior art does not show or suggest a circuit where both the first and second waveforms are polygon waveforms. Therefore, claim 1 is not anticipated or obvious and is thus patentably distinct from the cited prior art. Claims 2 and 5 are dependent upon claim 1 and thus include every limitation of claim 1. Therefore, claims 2 and 5 are also patentably distinct from the cited prior art.

Also in contrast to the cited prior art, claim 17 includes:

a first driver for applying a first time varying driving signal having a first waveform to the piezoelectric element in a polarization direction thereof; and

a second driver for applying a second time varying driving signal having a second waveform to the piezoelectric element equal to or smaller than a voltage of inversion of polarization of the piezoelectric element in a direction opposite to the polarization direction;

wherein the first waveform is a polygon waveform and the second waveform is a polygon waveform.

As noted above, the cited prior art does not show or suggest an apparatus where both the first and second waveforms are polygon waveforms. Therefore, claim 17 is not anticipated or obvious and is thus patentably distinct from the cited prior art. Claim 18 is dependent upon claim 17 and thus include every limitation of claim 17. Therefore, claim 18 is also patentably distinct from the cited prior art.

Also in contrast to the cited prior art, claim 23 includes:

a first driving signal having a first waveform and having a maximum voltage smaller than a voltage of inversion of polarization of the piezoelectric element is applied to the piezoelectric element in a polarization direction of the piezoelectric element; and

a second driving signal having a second waveform and having the same voltage but the inverted polarization is applied to the piezoelectric element in a direction opposite to the polarization direction of the piezoelectric element;

wherein the first waveform is a polygon waveform and the second waveform is a polygon waveform.

As noted above, the cited prior art does not show or suggest an apparatus where both the first and second waveforms are polygon waveforms. Therefore, claim 23 is not anticipated or obvious and is thus patentably distinct from the cited prior art. Claim 24 is dependent upon claim 23 and thus include every limitation of claim 23. Therefore, claim 24 is also patentably distinct from the cited prior art.

Accordingly, it is respectfully requested that the rejection of claims 1, 2, 5, 17, 18, 23 and 24 under 35 U.S.C. § 102(e) as being anticipated by the Atsuta Patent, be reconsidered and withdrawn.

35 U.S.C. § 103(a) Rejection

The rejection of claim 6 under 35 U.S.C. § 103(a), as being unpatentable over the Atsuta Patent, in view of the Tsukimoto Patent, is respectfully traversed based on the following.

As noted above, the Atsuta patent does not show or suggest an apparatus where the first and second waveforms are polygon waveforms. This is also not shown in the Tsukimoto patent. To show *prima facie* obviousness, the combined references must show every limitation of the claim. MPEP §2143. Claim 6 is dependent upon claim 1. The combined references do not show every element of claim 6 and thus claim 6 is nonobvious. Therefore, claim 6 is patentably distinct from the cited prior art.

Accordingly, it is respectfully requested that the rejection of claim 6 under 35 U.S.C. § 103(a) as being unpatentable over the Atsuta Patent, in view of the Tsukimoto Patent, be reconsidered and withdrawn.

New Claims

In contrast to the cited prior art, new claim 27 includes an apparatus:

wherein said second driving signal ... has a maximum voltage approximately equal to the maximum voltage of the first driving ...

Signal A of the Atsuta patent is boosted by coil 6 and has a maximum voltage far higher than Signal A' as shown in Figure 2A. The cited prior art does not show or suggest a limitation where the first driving signal and the second driving signal have approximately equal maximum voltages. Therefore, claim 27 is patentably distinct from the cited prior art. Claims 28-32 are dependent upon claim 27 and thus include every limitation of claim 27. Therefore, claims 28-32 are also patentably distinct from the cited prior art.

Also in contrast to the cited prior art, claim 33 includes:

a first driver for generating a first driving signal, wherein the first driving signal has a maximum voltage smaller than a voltage of inversion of polarization of the piezoelectric element and has a first waveform derived from the waveform signal, the first driver being coupled to provide the first driving signal to the piezoelectric element in the polarization direction of the piezoelectric element; and

a second driver for generating a second driving signal, wherein said second driving signal has a maximum voltage smaller than the voltage of inversion of polarization of the piezoelectric element and has a second waveform derived from the waveform signal, the second driver being coupled to provide the second driving signal to the piezoelectric element in a direction opposite to the polarization direction;

wherein the second waveform is an inversion of the first waveform.

Signal A of the Atsuta reference is a sinusoidal type wave form and signal A' is a square wave. In addition, signal A has a different amplitude than signal A'. Therefore, the cited prior art does not show or suggest an apparatus where the second waveform is an inversion of the first waveform. Thus, claim 33 is patentably distinct from the cited prior art. Claims 34-37 are dependent upon claim 33 and thus include every limitation of claim 33. Therefore, claims 34-37 are also patentably distinct from the cited prior art.

CONCLUSION

Wherefore, in view of the foregoing amendments and remarks, this application is considered to be in condition for allowance, and an early reconsideration and a Notice of Allowance are earnestly solicited.

This Amendment increases the number of independent claims by 2 from 4 (previously paid for 5) to 6 and increases the total number of claims by 11 from 16 to 27 (previously paid for 26), but does not present any multiple dependency claims. Accordingly, a Response Transmittal and Fee Authorization form authorizing the amount of \$102.00 to be charged to Sidley Austin Brown & Wood LLP's Deposit Account No. 18-1260 is enclosed herewith in duplicate. However, if the Response Transmittal and Fee Authorization form is missing, insufficient, or otherwise inadequate, or if a fee, other than

the issue fee, is required during the pendency of this application, please charge such fee to Sidley Austin Brown & Wood LLP's Deposit Account No. 18-1260.

Any fee required by this document other than the issue fee, and not submitted herewith should be charged to Sidley Austin Brown & Wood LLP's Deposit Account No. 18-1260. Any refund should be credited to the same account.

If an extension of time is required to enable this document to be timely filed and there is no separate Petition for Extension of Time filed herewith, this document is to be construed as also constituting a Petition for Extension of Time Under 37 C.F.R. § 1.136(a) for a period of time sufficient to enable this document to be timely filed.

Any other fee required for such Petition for Extension of Time and any other fee required by this document pursuant to 37 C.F.R. §§ 1.16 and 1.17, other than the issue fee, and not submitted herewith should be charged to Sidley Austin Brown & Wood LLP's Deposit Account No. 18-1260. Any refund should be credited to the same account.

Respectfully submitted,

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APPENDIX

VERSION WITH MARKINGS TO SHOW CHANGES MADE

The following is a marked-up version of the changes to the claims which are being made in the attached response to the Office Action dated July 23, 2002.

IN THE CLAIMS:

1. (Twice Amended) A driving apparatus for driving a piezoelectric element serving as a driving source of an actuator comprising:
 - a waveform generator for generating a waveform signal varying over time;
 - a first driver for generating a first driving signal, wherein the first driving signal has a maximum voltage smaller than a voltage of inversion of polarization of the piezoelectric element and has a first waveform derived from the waveform signal, the first driver being coupled to provide the first driving signal to the piezoelectric element in the polarization direction of the piezoelectric element; and
 - a second driver for generating a second driving signal, wherein said second driving signal has a maximum voltage smaller than the voltage of inversion of polarization of the piezoelectric element and has a second waveform derived from the waveform signal, the second driver being coupled to provide the second driving signal to the piezoelectric element in a direction opposite to the polarization direction[.];

wherein the first waveform is a polygon waveform and the second waveform is a polygon waveform.
2. (Twice Amended) A driving apparatus in accordance with claim 1, wherein the second [driving signal has a] waveform [which] is an inversion of the first waveform. [a waveform of the first driving signal.]
3. (Twice Amended) A driving apparatus in accordance with claim 1, wherein the [waveforms of the] first and second [driving signals] waveforms are sine waves.

4. (Once Amended) A driving apparatus in accordance with claim 1, wherein the [waveforms of the] first and second [driving signals] waveforms are sawtooth waves in which the inclination in a rising portion is different from that in a falling portion.

17. (Thrice Amended) A driving apparatus for driving a piezoelectric element serving as a driving source of an actuator comprising:

a first driver for applying a first time varying driving signal having a first waveform to the piezoelectric element in a polarization direction thereof; and

a second driver for applying a second time varying driving signal having a second waveform to the piezoelectric element equal to or smaller than a voltage of inversion of polarization of the piezoelectric element in a direction opposite to the polarization direction[.];

wherein the first waveform is a polygon waveform and the second waveform is a polygon waveform.

23. (Thrice Amended) A method for driving an actuator having a piezoelectric element serving as a driving source characterized by:

a first driving signal having a first waveform and having a maximum voltage smaller than a voltage of inversion of polarization of the piezoelectric element is applied to the piezoelectric element in a polarization direction of the piezoelectric element; and

a second driving signal having a second waveform and having the same voltage but the inverted polarization is applied to the piezoelectric element in a direction opposite to the polarization direction of the piezoelectric element[.];

wherein the first waveform is a polygon waveform and the second waveform is a polygon waveform.

24. (Twice Amended) A method in accordance with claim 23, wherein the second [driving signal has a] waveform [which] is an inversion of the first waveform. [a waveform of the first driving signal.]

25. (Twice Amended) A method in accordance with claim 23, wherein the first and second waveforms [of the first and second driving signals] are sine waves.

26. (Twice Amended) A method in accordance with claim 23, wherein the first and second waveforms [of the first and second driving signals] are sawtooth waves in which the inclination in a rising portion is different from that in a falling portion.